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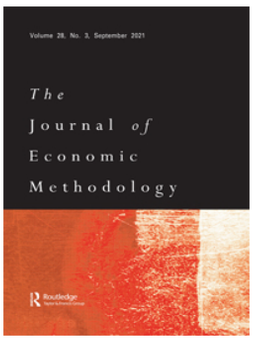

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ABSTRACT

An intuitively appealing argument for pluralism in economics can be made on the grounds that schools of economic thought complement one another. Let us call this the *complementarity-based argument for pluralism* (CAP). The concepts of complementarity, pluralism, and school of thought are scrutinized in this paper to evaluate this argument. I argue that the complementarity of schools is relative to scientific goals, which implies that discussing complementarity of schools of economic thought requires discussing the goals of economic research. I also distinguish weak from strong complementarity and show that some alleged complementarity relations between schools are weak and thus provide little support for CAP. However, if strong complementarity relations, relative to a valuable goal, can be demonstrated to exist between specific schools, this is a strong reason for pluralism about those schools. Finally, I provide suggestions on how to distinguish strong from weak complementarity.

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Complementarity; pluralism; schools of thought

1. Introduction

Throughout the history of economics, we find a variety of prefixes, such as 'Keynesian', '(neo)classical', 'institutional', and 'behavioral', attached to the word 'economics'. Each of these labels tries to capture a distinct approach to economics. In some periods, there has been more consensus about the fundamentals of the discipline, whereas other periods have been marked by more widespread debates concerning the best approaches (Davis, 2008). These distinct approaches are often called 'schools of thought'. In recent years, it has become increasingly popular to believe that economics could be a better discipline if these diverse schools of thought enjoyed more equal attention and cultivation. By now, the calls for this diversity and activities to promote the diversity make up a whole movement organized under the concept of *pluralism in economics*. In addition to an abundance of journal articles, several edited volumes consisting of papers that argue for pluralism have been published (Courvisanos et al., 2016; Decker et al., 2019, 2020; Fullbrook, 2008c; Garnett et al., 2010; Salanti & Screpanti, 1997). There are also various organizations that explicitly aim to advance pluralism.[1]

The arguments for pluralism are many and varied, and in this paper, I will discuss only one of the possible ways to argue for pluralism. I will examine the idea that schools of thought complement each other, so more than one of them are needed. I call this the *complementarity-based argument for pluralism*. As I argue in section 4, one version of this argument is implicit in much of the literature

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on pluralism in economics, but it relies on assumptions that have not been carefully examined. Thus, in this paper, my aim is to answer the following questions: What would it be for schools of thought to be complementary? Can schools of thought be complementary? Does complementarity justify pluralism about schools of thought? I will argue that the complementarity-based argument for pluralism holds promise but requires further empirical research as well as further discussion on the goals of economic research. My conclusions do not affect other kinds of arguments for pluralism.[2]

First, I discuss the concepts of pluralism (section 2) and school of thought (section 3). Then, I analyze how the concept of complementarity is used in the literature on pluralism in economics (section 4) and why it should be treated as a goal-relative property (section 5). In section 6, I define two kinds of complementarity of schools – weak and strong complementarity. Both share the idea that a complementary school has some feature by virtue of which it can complement other schools. Moreover, a school is complementary to another if and only if using this complementary feature along with the features of the complemented school advances a scientific goal. That the complemented schools can benefit from the complementary feature in their future research may or may not require ongoing research in the complementary school. I label these respective situations strong and weak complementarity, strong complementarity being a stronger argument for promoting the plurality of schools in contemporary research. In section 7, I consider how weak and strong complementarity can be distinguished in practice. Section 8 discusses the challenges that the goal-relativity of complementarity creates for complementarity-based arguments for pluralism. Section 9 concludes.

2. Pluralism

Starting from the very general idea that pluralism is 'a theory or principle that justifies or legitimizes or prescribes the plurality of items of some sort' (Mäki, 1997, p. 38), we can ask questions to specify what is meant by 'pluralism' in each case. Depending on the question, we get different classifications of pluralism.

The most obvious question is, 'the plurality of what items are we talking about?' To that question, some familiar answers are: theories, models, methods, systems of representation, approaches, paradigms, schools of thought, and so on. Some of these items allow for a further question about the nature and magnitude of difference between the items. For example, are we talking about the endorsement of a range of diverse models or a multitude of variations to one core model? In this paper, the focus is on pluralism about schools of economic thought.

Furthermore, we can ask what exactly a justification, legitimization or prescription of plurality amounts to. Does the theory prescribe a plurality of given items in *contemporary* scientific institutions? Or does it justify plurality in *past* practices? Is the current, past, or future plurality simply judged to be (or to have been) beneficial in some sense, as a matter of passive observation? Or does pluralism go further and amount to a call to actively *promote* plurality? By 'promoting plurality', I mean either campaigning for more plurality if there is not enough of it or taking steps to preserve the current extent of plurality. This is the meaning of 'pluralism' endorsed by Hasok Chang (2012, p. 260):

> [A] proper "ism" should be an ideology, which implies a commitment to action. So, pluralism about science is a commitment to promote the presence of multiple systems of scientific knowledge. It is not an idle pronouncement to "let a hundred flowers bloom", but the effort of actively cultivating the other 99 flowers.[3]

In this paper, I am concerned with forms of pluralism that endorse the promotion of a plurality of schools. After all, as a movement, the pluralism movement seeks to bring about changes in the contemporary scientific community. I call this position *prescriptive pluralism about schools of thought*. Prescriptive pluralism differs from pluralism that evaluates past advantages and disadvantages of plurality – one cannot prescribe that a given amount of plurality should have existed. I want to highlight two other features of prescriptive pluralism. Promoting plurality (in science policy or among

scholars themselves) requires persuading others of the need for more plurality. And a legitimate prescription of plurality presupposes more than an acknowledgement of its benefits, namely, the judgment that there are no alternative and better means to obtain those benefits (whatever one considers them to be).

3. Schools of thought

The notion of a school of thought has a double meaning: it refers to a set of views about research and its object and to the group of researchers who share those views (Negru, 2013). Let us call these the intellectual dimension and the social dimension of schools.

Let us first consider the intellectual dimension. I understand schools of thought as constellations of ideas which guide the research of a community of scholars in a discipline. I call these ideas *intellectual features* of schools, because the adherence of a school's members to the ideas is a peculiar feature of a school. These features include, but arguably are not limited to:

- Core assumptions (Are agents rational? Are agents homogeneous?)
- Methodological norms (Are structural explanations permissible? Should explanations refer to equilibria?)
- Methods (differential analysis, regression analysis, simulations, experiments, qualitative methods …)
- Conceptual frameworks (What entities do the frameworks include? What is the meaning of concepts like 'value', 'rationality', and 'capital'?)
- Metaphysical convictions of key features of the domain of study (Conflict or harmony? Individuals or structures? Stability or instability?)
- Models (which may be distinctive to a school of thought if they are built from a distinct combination of these elements)
- General conclusions about policy recommendations and causal structures (which tend to differ between schools as a result of the other elements differing)

There is no clear-cut division between schools of thought, but the sorts of features listed above often form sufficiently recognizable patterns to warrant arranging them into schools of thought. However, the term 'school of thought' is not crucial for the argument set forth in this paper. Some authors instead use the Kuhnian and Lakatosian concepts of *paradigms* (Dow, 2004; Garnett, 2006), *disciplinary matrices* (Dow, 2012) or *research programs* (Davis, 2008; Gräbner, 2017b) to refer to these constellations of ideas.

On the other hand, schools are *epistemic communities*, each of which is united by the distinctive intellectual features.[4] When we talk about prescriptive pluralism about schools of thought, we are not exactly interested in the *existence* of these intellectual features and their constellations. Instead, we are interested in the *continuing development and use* of the features. However, scientific ideas do not develop and apply themselves; researchers and groups thereof develop and apply the ideas. Thus, we should bear in mind that arguments for prescriptive pluralism about schools of thought are arguments for promoting a plurality of these epistemic communities.

4. Complementarity in the literature on pluralism

Complementarity has several meanings. There are everyday meanings, such as a specific wine being a good complement to a specific food, as well as distinct theoretical meanings in various sciences – in economics, goods with a negative cross-price elasticity are said to be complements. In this paper, the task is to clarify the *meta-theoretical* meaning of complementarity in the context of schools of economic thought.[5]

A brief look at the literature on schools of economic thought reminds us how ubiquitous the concept of complementarity is. Negru and Negru (2017, p. 195) summarize the views presented by various pluralist economists ('Roundtable Dialogue on Pluralism,' 2015) thus: 'Pluralism views alternative approaches as potentially complementary, offering a diversity of relevant insights, implying thus a respect for the co-existence of paradigms'. Leonhard Dobusch and Jakob Kapeller (2012, p. 1042) write, 'Indeed, it might turn out that theories, seemingly different and competing, are, in fact, neutral or containing complementary sets of statements, while simply answering different questions'. Similarly, they suggest that if 'institutional economics could provide the microeconomic foundations of post-Keynesian economics', this would be a case of 'potential integration due to complementarity' (2012, p. 1051). According to Kapeller and Schütz (2013, p. 516), some elements of the theories of J. M. Keynes, Minsky, and Veblen 'prove to be complementary in the sense that their combination creates novel, empirically relevant results that cannot be reached without relying on each other'. In the same way, Claudius Gräbner (2017a) argues that institutional economics can complement complexity economics by providing a certain methodological norm for it, and that complexity economics can complement institutional economics by offering computational methods. Plenty of similar examples can be found (Denis, 2009, p. 13; Garnett, 2006, p. 523; Keller, 1983; Kronenberg, 2010, p. 1488; Kurz & Salvadori, 1997, p. 234; Olsen, 2007, p. 59).

Even within one paper, the concept is sometimes used in a variety of ways. Dobusch and Kapeller (2012) use 'complementarity' to denote a property that two 'sets of *statements*' can have in virtue of 'answering different questions' (p. 1042) as well as a property that '*phenomena*' may have (p. 1051). Complementarity is related to situations 'where statements deal with completely *unrelated* phenomena' (p. 1051) as well as to situations where 'theoretical statements […] are (apparently) *incompatible*' (p. 1052) (all italics mine).

Furthermore, arguments for pluralism include implicit appeals to complementarity. Gräbner (2017b) seems to draw on the idea of a complementary relationship between schools of thought (or 'research programs') when he argues that every research program 'inevitably has some "blind spots," which might be addressed by a different approach'. Likewise, Edward Fullbrook (2008a, p. 3) insists that from 'different points of view' taken by different schools, researchers can see something that other points of view do not allow. This variety prompts the question, what exactly does complementarity mean, and does it have something to do with pluralism? Do some meanings of complementarity relate to pluralism more closely than others?

Some remarks and distinctions are in order. First, in this literature, complementarity is usually ascribed to scientific ideas (theories, methods, models, etc.) which constitute the intellectual dimension of the schools, as I explained in the previous section. When complementarity is ascribed to schools of thought, this can be traced back to the complementarity of the intellectual features of the schools (regardless of how each author understands the complementarity of the features). This is similar to the philosophy of science literature, in which complementarity is also understood as a property of scientific ideas of different types. For example, Uskali Mäki (1997, p. 41) focuses on the complementarity of *theories* and distinguishes strongly complementary theories from weakly complementary ones based on how ontologically fundamental their complementary claims are. In his account, strongly complementary theories 'contain complementary core claims to parts of the whole truth about the ontic core', while weakly complementary theories 'contain complementary peripheral claims to parts of the whole truth about the ontic periphery'. Caterina Marchionni (2008, p. 315) focuses on the complementarity of *explanations*. In her account, strongly complementary micro- and macro-level explanations can be integrated, 'and when integrated, they provide better […] explanations'. Weakly complementary explanations, in contrast, 'are both legitimate and autonomous, and are complementary in virtue of possessing different explanatory virtues'.

Second, that some scientific ideas are complementary often means that they can be used together or combined in some sense, in a way that results in scientific advancements. The word 'cross-fertilization' is sometimes used to express the idea of complementarity not as the mere coexistence of ideas and views but as the joint use of them. However, not all notions of

complementarity rely on cross-fertilization and combination. Two or more theories, models, or other items are sometimes said to be complementary if they address different questions. Dobusch and Kapeller (2012, p. 1042) use this notion of complementarity when they write that theories may contain 'complementary sets of statements, while simply answering different questions'. But theories, models, and other items representing or saying something about an object cannot be complementary by virtue of representing different parts of the object if they are not about the same object. As I argue in the next section, demarcating such an object is difficult. Even so, the complementarity of independent co-existing items makes sense when each results in a scientific advancement and these advancements together constitute steps toward a broader goal. I return to this issue in section 8.

Third, complementarity can be ascribed to intellectual features that a school either has already developed or is expected to develop in the future. Fourth, and related to the previous point, sometimes complementarities between the features are considered to have been discovered or demonstrated. However, more often, complementarity is anticipated – further research must be done to learn which ideas really are complementary.[6] The expression 'potential complementarity', which recurs in the literature, is thus doubly hypothetical: actualized complementarity requires both developing suitable ideas and discovering that their joint use advances some scientific goals.

Taken together, these remarks enable us to formulate what we can call the *anticipated cross-fertilization* (ACF) argument. This argument has not been explicitly endorsed, but I believe many pluralist authors have something like this in mind. The ACF argument provides a fruitful starting point for analyzing how complementarity can be (and how it cannot be) used to argue for pluralism.

> **[ACF]** Prescriptive pluralism about schools is justified, because the existence of a plurality of schools facilitates the development of complementary intellectual features, which may be brought together in unforeseeable ways to advance research.

Two clarifications of the ACF argument are needed. Bringing together intellectual features may happen in various ways, such as by using them side by side, by borrowing them from their original context, or by combining or integrating them. Additionally, in ACF and throughout this paper, the expression 'to advance research' must be understood relative to alternative courses of action: a course of action counts as an advance if it brings us closer to our goals than alternative courses of action would.

ACF is a promising start for formulating a complementarity-based argument for pluralism, but to make it convincing, additional assumptions must be introduced and defended. First, the argument needs the assumption that a plurality of schools has a significant or even indispensable role in developing the ideas that are expected to prove complementary. Naturally, exactly how important the role is affects the strength of the argument for pluralism. For brevity, I will call this the *indispensability assumption*. But novel ideas come from all kinds of sources, so while it arguably is useful that researchers draw inspiration from many sources, a plurality of schools does not have a self-evidently prominent role among all the sources of new ideas. Furthermore, even if one school has generated an idea that has proved to be complementary to research done by other schools, this does not straightforwardly imply that the school will keep on generating more complementary ideas. Thus, although the indispensability assumption is not unreasonable, it deserves scrutiny.

Second, the argument needs the assumption that using the complementary ideas helps to produce not only new knowledge, but also important knowledge. Let us call this the *importance assumption*. I discuss this assumption in section 8, but first, let us focus on the indispensability assumption.

Below, I will define two kinds of complementarity between schools. Weak complementarity advances a specific scientific goal without justifying the indispensability assumption. Strong complementarity, in addition, satisfies the indispensability assumption and provides therefore a stronger reason for prescriptive pluralism about schools. However, before defining complementarity, I

want to counter an objection the definition might elicit – I will explain why complementarity must be defined as a goal-relative property.

5. The goal-relativity of complementarity

Dictionaries define the word 'complement' along the lines that to complement something is to make it more complete. Many authors on pluralism indeed seem to have an intuition that the knowledge that several schools have together is more complete than the knowledge of one school alone, or that further research efforts bring us closer to complete knowledge when they stem from several schools of thought in contrast to when research is pursued within just one school. Fullbrook (2008b, p. 84, 105), for instance, draws an analogy between schools of thought on one hand, and the perspectives from which a sculpture can be viewed, on the other. In his view, seeing all sides of the metaphorical sculpture, gaining a 'full appreciation' of it, requires having more than the perspective of a single school.

'More complete knowledge' is too ambiguous an idea for understanding the question about pluralism. Fullbrook's analogy is misleading, because sculptures have clear boundaries, which is not the case for abstract concepts like 'economy', 'work', or 'value'. The extension of these concepts depends on the theoretical framework. For a feminist economist, unpaid care work counts as a part of the economy, while a neoclassical economist might not see it as a part of the economy. For the feminist economist, increased knowledge about unpaid care work counts as a step toward more complete knowledge of the economy, while for the neoclassical economist, it would at most amount to an increase in knowledge about things outside the economy. Thus, one cannot straightforwardly claim that schools of thought provide several complementary perspectives to a clearly demarcated entity called the economy.

Therefore, while the idea of *making knowledge more complete* is important for the concept of complementarity, making sense of the idea of completeness in this context requires reference to the human subjects of knowledge. What counts as completeness worth aiming for depends on interests and purposes.[7] To take these issues into account, the framework introduced below interprets complementarity as a goal-relative property. Of course, scientists pursue many goals, from small intermediate steps to grand visions of final theories, and there are disagreements about what the most valuable goals are. This can result in disagreements about what valuable complementarity is and disagreements about whether the abovementioned importance assumption is justified. I will return to this question in section 8. For now, we only need to bear in mind that schools are complementary in view of some goals.

6. Strong and weak complementarity

Recall that the ACF argument includes the view that the complementarity of schools derives from the fact that researchers can use or 'borrow' the various intellectual features of other schools to advance their research in some ways. Building on this view, I propose the following definition of *weak complementarity* of schools:

[WC] A school X_1 is weakly complementary to another school or set of schools X_2 iff

(a) X_1 has a feature Y_1, which X_2 does not have, and

(b) using Y_1 along with the features of X_2 advances a valuable scientific goal G.

The word 'using' should be understood figuratively and broadly, because the intellectual features Y come in many kinds and are brought into play in many ways. Recall that the features include, among other things, methods, and models. A method can be *applied* to study a hypothesis. One model may be *integrated* with another model. Models can be *compared* with each other to draw conclusions about issues such as the robustness of a result or the distribution of models' predictions.

To see how this definition is consistent with views about the complementarity of schools, let us apply it to an example proposed in the literature. Claudius Gräbner (2017a) argues that institutional economics is complementary to complexity economics, and vice versa. He argues that institutional economics can benefit from the computational methods applied in complexity economics, and this facilitates the goal of discovering causal mechanisms. Substitute 'complexity economics' for X_1, 'institutional economics' for X_2, 'computational methods' for Y_1, and 'the discovery of mechanisms' for G, and we get Gräbner's argument that complexity economics is complementary to institutional economics, as:

(a) Complexity economics has computational methods, which institutional economics does not have, and
(b) using the computational methods along with the features of institutional economics advances the discovery of mechanisms.

Gräbner argues that the complementarity goes in the opposite direction as well, but for another reason. Complexity economics can borrow from institutional economics a norm regarding how to demarcate between better and worse explanations – the norm of *deep explanation*. This norm tells that a theory is preferable to another 'if it explains [the same] observed phenomena with recourse to more of the underlying mechanisms' (Gräbner, 2017a, p. 396).[8] Thus, Gräbner argues that institutional economics is complementary to complexity economics, because:

(a) Institutional economics has the methodological norm of deep explanation, which complexity economics does not have, and
(b) using this methodological norm along with the features of complexity economics advances the capacity of 'discriminat[ing] between competing mechanism-based explanations' (Gräbner, 2017a, p. 396).

These relations between schools should be considered only weakly complementary, because we have not yet justified the indispensability assumption – neither the indispensability of institutional economics for using the said methodological norm nor the indispensability of complexity economics for using the said methods.

Why might complexity economics not be needed to benefit from the methods that in Gräbner's view are complementary to institutional economics? In many cases, methods can be adopted from another school while disregarding all other features that constitute that school. Thus, even if institutional economics benefited from the methods of complexity economics in some way, this would not imply that one needs complexity economics as a whole to realize that benefit. But what if the school of complexity economics was necessary to develop the methods in the first place?[9] This may well be true – perhaps the school *was* indispensable at one point. If so, we should appreciate the fact that the school has developed the methods and we now have them at our disposal. However, to argue for prescriptive pluralism on the basis of complementarity, to compel us to *ensure the continuing work* in the complementary school, we should show that new valuable intellectual features are expected to come from the school also from now on. In the next section, I discuss the prospects of showing that this is the case.

Moreover, the norm that instructs us to look for deep explanations is far from unique to institutional economics, and one does not need institutional economics to use the norm in one or other piece of research. The norm is ubiquitous in much of social scientific research, although in various disciplines it may be interpreted in differing ways. The methodological norm can be 'borrowed' from institutional economics and used in another field of research, but it could also be 'borrowed' from elsewhere. Even if institutional economics had a unique interpretation of the deep explanation norm, other schools could just adopt the norm without seeing a need for further research efforts by that school. The indispensability assumption is violated again.

The above reflections suggest an obvious conclusion. Because a plurality of schools might not be necessary to reap the benefits ascribed to complementarity, weak complementarity is not a very convincing argument for prescriptive pluralism. Let us therefore define *strong complementarity* by introducing a third condition:

[SC] A school X_1 is strongly complementary to another school or set of schools X_2 iff

(a) X_1 has a feature Y_1, which X_2 does not have, and

(b) using Y_1 along with the features of X_2 advances a valuable scientific goal G, and

(c) X_1 is indispensable for benefiting from Y_1 now or in the future.[10]

The identification of complementarity comes in degrees: the belief can be more or less justified that conditions (a) to (c) are satisfied in a given case. It seems relatively easy to see if condition (a) is satisfied. The literature, such as the abovementioned papers by Gräbner (2017a) and Kapeller and Schütz (2013), also includes ideas about which schools satisfy condition (b). However, justifying the belief in condition (c), and thus distinguishing strong from weak complementarity, has been neglected in the literature. This is the topic of the next section.

Demonstrating complementarity relations between schools amounts to showing that plurality can advance some specific scientific goals and does not only make the advancement of some currently unknown goals more likely, as the ACF argument would have it. Furthermore, if the complementarity is strong, some plurality of schools is necessary for benefiting from the complementarity of the features. Therefore, if we can show that there are strong complementarity relations between schools, this would constitute a strong argument for pluralism with respect to those schools. Before turning to discuss the details, we can now state in abstract terms the main claim of this paper: *Prescriptive pluralism is warranted (at least)*[11] *with respect to schools of thought that are strongly complementary to some other school(s), relative to a valuable scientific goal.* Therefore, proponents of pluralism should look for strong complementarity relations.

7. Where can we find strong complementarity?

In this section, I discuss the challenge of telling which complementarities between schools might be strong, and which are more likely to be weak. The consideration of different complementarity relations is not exhaustive, and I can only show the first steps in the endeavor of distinguishing strong from weak complementarities. The section is to be read as a set of hypotheses to be examined in the project of mapping the complementarities between schools.

When we are looking for strong complementarities, we are looking for cases in which further research efforts in one school (X_1) are needed to make or keep available ideas (Y_1) that other schools (X_2) can take up to advance some scientific projects (G). If past research efforts in X_1 suffice for the availability of Y_1, we have weak complementarity, as there is no complementarity-related reason for ensuring a place for X_1 in contemporary research pursuits; the school has already done its job, as it were. One way to argue for the importance of continuing research efforts in a particular school is when we can 'extrapolate' from already demonstrated complementarities to justifiably anticipated complementarities. This idea appears to be implicit (but only implicit) in much of the discussion on complementarity. However, developing the idea satisfactorily requires attention to two assumptions, which I introduce below as the *continuity assumption* and the *uniqueness* assumption.

David Colander (2010) has suggested a role for heterodox economics, which builds on the fact that schools of thought have the social dimension in addition to the intellectual one. Colander argues that heterodox schools can advance the progress of economics by serving as 'incubators' of novel ideas. In his view, original and bold ideas can be developed in heterodox schools, where they are not hastily dropped for not being expressible in formal models. Eventually, the adequacy

of the ideas must be tested by offering them to be taken up by the mainstream economics community. The incubator metaphor directs attention from the features that schools currently have to the features they can be expected to develop. By building on Colander's idea, we can better understand where we might find strong complementarities. For example, schools have models typical for them, but they also develop new models. Furthermore, this development is somewhat predictable, and in this predictability lies the key to understand when we can extrapolate from complementarities demonstrated in the past to complementarities expectable from further research efforts.

The intellectual features of schools differ in what it takes to develop them to their full potential. Some of the features, such as models, are developed further and more variations and refinements of them are made. In contrast, some features, such as methodological norms, are more stable. Once they are conceived, they change slowly, if at all. Next, I will comment various kinds of intellectual features the schools-as-incubators might produce and what they mean for complementarity.

I will start by recapping what I said above about the complementarity relations proposed by Gräbner. When a school is said to be a complement by virtue of a *methodological norm*, as Gräbner (2017a) suggests, the complementarity is most likely to be weak. If for some reason other schools find that norm to be useful, they can adopt the norm in their own research while disregarding all other intellectual features of the supposedly complementary school. Furthermore, schools of thought do not constantly create new methodological norms nor refine the existing ones. If they did, one could argue that the school will create methodological norms that perhaps prove to be helpful for other schools, so continuing work within the school is worth ensuring. The supposedly complementary school might have some other features it can offer, but methodological norms do not make any school of thought indispensable.

Individual methods of analysis applied in one school do not make the school strongly complementary to other schools, because methods can be adopted independently of the research context in which the methods were first developed. For example, day-to-day research in mainstream economics involves using mathematical methods of analysis, the origin of which was not in economics. Thus, if Gräbner (2017a) is right that complexity economics has developed methods that institutional economics could benefit from, perhaps institutional economists could just take up the methods without insisting on cultivating further research on complexity economics. On the other hand, if the project of developing those methods is ongoing (call this the *continuity assumption*) and if the project is only (or mainly) advanced in the school of complexity economics (call this the *uniqueness assumption*), we have a reason to believe that the conditions of strong complementarity are satisfied. In such a case, we would conclude that ongoing work in complexity economics is indispensable for fully developing those methods and thus indispensable for fully reaping the benefits suggested by Gräbner.

Individual empirical claims or *hypotheses* made by one school do not make the school strongly complementary to other schools, even if the claims are peculiar to that school. Other schools can take up those claims and hypotheses and study them using their methods, models, and so on. For example, Kapeller and Schütz (2013, 2014) plausibly argue that Veblen's notion of conspicuous consumption can complement theoretical ideas held by other schools by serving as a building block of an explanation of financial crises. The notion of conspicuous consumption can be understood as claims or stylized facts about how rising economic inequality affects the borrowing and labor market behavior of individuals. The authors correctly refrain from arguing that this individual complementary claim would imply the complementarity of the school – institutional economics – with which Veblen is associated, to other schools. This is because the claims about consumer behavior can be taken up by mainstream economics, and indeed have been, without this implying a need to cultivate further research in institutional economics (see the reference list provided in Kapeller & Schütz, 2014, p. 784).

However, a continuing project of presenting distinctive claims or hypotheses might justify the belief in strong complementarity. Suppose that (1) a school has a track record of introducing hypotheses of the kind that other schools rarely present, and that (2) the examination of those hypotheses

by other schools advances some valuable scientific goals. Suppose further that (3) to come up with more such hypotheses, further work by the said school is needed. Such a school would be strongly complementary to the other schools taking up its hypotheses. Naturally, condition (3) is not easy to substantiate.

By this point, it should not come as a surprise that I do not think single *models* make a school strongly complementary to other schools. Instead, the suggestions that models make a school complementary to another can be more plausibly formulated as being about families of models giving rise to the complementarity. It is not inconsistent to borrow previously developed models from one school while *not* believing that further research efforts in that school are going to be valuable. However, if one believes that the school has an ongoing and distinctive project of developing a family of useful models, then one in effect believes that further research efforts in that school are something worth cultivating.

For example, it has been suggested that agent-based (AB) macroeconomic models could be improved by integrating them with the stock-flow consistent (SFC) modeling framework (Caiani et al., 2016). Post-Keynesian economists have played an essential role in the development of the SFC modeling approach (Caverzasi & Godin, 2015; Nikiforos & Zezza, 2017). Thus, one could argue that post-Keynesian economics strongly complements the schools engaged in AB modeling – such as evolutionary and complexity economics – by virtue of developing the family of SFC models that in time can be integrated with AB models.

The distinction between weak and strong complementarity is fallible. Empirical research on the strength of complementarities would have to examine issues related both to the continuity assumption (Is the development of complementary models, methods, or hypotheses a thriving project or a stagnating one?) and to the uniqueness assumption (Do other schools develop similar models, methods, or hypotheses?).

8. Complementarity and the goals of inquiry

Finally, we must take up an issue that was postponed earlier. What about the 'importance assumption' highlighted in section 4 – the assumption that the complementarity advances some valuable goals and thus is a reason for prescriptive pluralism? What kinds of goals are there, and what if people disagree on which ones are valuable?

One option is that complementarity leads to better explanations of phenomena that are already considered as important *explananda*. This would be the case if SFC-AB models revealed new insights about how financial crises happen. Here complementarity serves an established scientific goal. We might say that the research in a strongly complementary school helps to improve the way we understand financial crises. Another option is that complementarity leads to explanations of phenomena that thus far have not been widely considered to be important *explananda*. One might argue that feminist economics is strongly complementary to other areas of economic research on the grounds that it is engaged in the project of examining questions and hypotheses that other schools do not examine, such as those about unpaid work. Here complementarity serves scientific goals that are not yet well established.

As I mentioned in section 4, one may also think that some schools are complementary because they pursue *different* goals. This idea is consistent with the framework proposed in this paper, as G can stand for a set of sub-goals, which together constitute a broader, overarching goal. However, in this case, condition (b) in definitions **[WC]** and **[SC]** – using Y_1 along with the features of X_2 advances a valuable scientific goal G – must be understood rather broadly. Suppose that a school X_1 has a feature Y_1, which school X_2 does not have, and X_1's members use Y_1 and other features typical to that school to advance their favorite goal G_1. Suppose further that there is a broader valuable scientific goal G*, of which G_1 is a sub-goal, and that X_2 pursues other parts of this broad goal (G_2, G_3 etc.) using the intellectual features typical to the school. Then, we may say that Y_1 is used (by the epistemic community consisting of schools X_1 and X_2) along with the features of X_2 in a way that

advances a valuable scientific goal G*. Thus, we have complementary schools. Whether the complementarity is weak or strong again depends on whether condition (c) is satisfied.

These views on what goals complementarity serves are in line with the broader literature on pluralism in economics. For example, Dobusch and Kapeller (2012, p. 1043) consider a plurality of schools engaging in constructive interaction – 'interested pluralism', in their terminology – to be useful with respect to producing 'an improved and expanded set of relevant explanatory statements'. On the face of it, this is a fine goal, irrespective of whether one endorses 'interested pluralism'. But it is contestable what *explananda* are important or relevant, and what counts as an improvement of explanation. To gain wide acceptance, arguments for pluralism must take seriously the contestability of scientific goals. Any complementarity-based arguments for pluralism invite objections from those who do not agree on the goals that a presumed complementarity serves.[12]

If a school X_1 is strongly complementary to a set of schools X_2, relative to a goal G, a person may still deny that this is a reason for prescriptive pluralism if she does not consider G to be worth pursuing. Additionally, if G, when described in abstract terms, is a commonly accepted scientific goal, there may be different interpretations of the goal and of what counts as advancing that goal. Thus, someone may doubt whether condition (b) of complementarity – 'using Y_1 along with the features of X_2 advances a valuable scientific goal G' – is satisfied after all. While Jeroen Van Bouwel (2004, p. 312) is right when he writes that 'talking about pluralism will have to go hand in hand with establishing the compatibility and complementarity of the different components', we must also keep in mind that talking about complementarity will have to go hand in hand with discussing the goals of economics and their value and interpretation.

9. Final remarks

I have argued that assessing and developing the complementarity-based argument for pluralism requires treating the complementarity of schools as a goal-relative property and distinguishing weak from strong complementarity. Some alleged complementarity relations between schools of thought are weak in the sense that one does not need to promote further research in the allegedly complementary school in order to benefit from the helpful feature of that school. On the other hand, I have indicated how strong complementarity relations are most likely to be found. In general, what can make schools of thought strongly complementary to other schools is not their individual past achievements. Many models, methods, and the like can be exploited in other areas while disputing the need to cultivate further research in the school that originally produced the exploitable ideas. Instead, what justifies the belief that a school is important for some scientific purposes is that the school continues to develop further an intellectual feature (e.g. a method or a family of models) which is peculiar to that school and which has been demonstrated to be exploitable by other schools. Such importance with respect to a specific scientific advancement is the kind of complementarity that can justify prescriptive pluralism about schools, independently of whether pluralism is also justifiable on other grounds. Prescriptive pluralism is warranted (at least) with respect to schools of thought that are strongly complementary to some other school(s), relative to a valuable scientific goal. Finally, I have argued that because the goals of scientific inquiry are contestable in their significance and interpretation, and because complementarity is a goal-relative property, complementarity-based arguments for pluralism must go hand in hand with arguments about the value of the goal that the complementarity serves.

While this paper has focused on the complementarity between schools of economic thought, one may wonder whether it additionally clarifies the complementarity between other items such as methods, theories, or models.[13] The definitions of weak and strong complementarity are constructed in view of the schools' peculiar nature as both constellations of intellectual features and social projects of further developing these features. That said, the more general notion of items being complementary due to their joint use being advantageous in light of a specific goal applies in many contexts – both theoretical and practical. One may also wonder whether the framework can be

applied to study the complementarity of schools in disciplines other than economics. These are interesting topics for further study.

The critical reader may question my insistence on the forward-looking nature of strong complementarity. After all, does it not justify pluralism that various schools of thought have thus far contributed ideas to economics – ideas that have advanced the progress of the discipline? However, it is a common view among economists who are not excited about pluralism that various now-marginal schools may indeed have contributed something useful *in the past*. However, they may continue, mainstream economics has taken up those insights, and it is best to pursue further research within the mainstream framework. To counter this objection, pluralists would do well to emphasize the potential ability of non-mainstream schools to produce useful ideas in the future. The project of demonstrating that this is the case, I suggest, benefits from the analysis of complementarity presented in this paper.

Notes

1. For example, International Confederation of Associations for Pluralism in Economics (https://icape.org/), Rethinking Economics (https://www.rethinkeconomics.org/) and Netzwerk Plurale Ökonomik (https://www.plurale-oekonomik.de/).
2. The complementarity-based argument for pluralism, as I understand it, is an epistemological argument for pluralism. There are also other epistemological arguments for pluralism, but those are not the focus of this paper. One such argument is that under uncertainty about the correct (or otherwise best) theory, approach, or research program, it is advisable to develop several of them, to avoid mistakenly disregarding the best one. Following Philip Kitcher (1990, p. 14) and Hasok Chang (2012, sec. 5.2.2.1), this argument could be labeled the hedging bets argument. In the philosophy of economics, the argument has been recently made by Gräbner and Strunk (2020, p. 319). Moreover, there are arguments for pluralism that are not epistemological but, for example, ethical (Dow, 2004, pp. 280–281, 2007, p. 453). However, these are not the topic of this paper.
3. Here, I only want to highlight Chang's distinction between 'letting the flowers bloom' if they do and actually cultivating plurality. I do not mean to take a stance on all specifics of his pluralist philosophy, which include the view that many discarded scientific concepts, such as phlogiston, should be revived.
4. Also, they are epistemic sub-communities within a discipline, and they may include further sub-sub-communities.
5. In particular, this meaning of complementarity differs from Niels Bohr's concept of complementarity in physics, in which complementarity amounts to 'concepts which cannot be used *at the same time*' or propositions 'excluding each other' (Da Costa & Krause, 2006, p. 106, orig. emphasis). In the literature on pluralism in economics, as will become clear below, 'complementarity' does not preclude 'combining' schools of thought or their elements.
6. Thanks to an anonymous reviewer for the advice to elaborate this point.
7. For a similar view, see (Brigandt, 2015).
8. Critically evaluating this norm, while important, is beyond the scope of this paper.
9. Thanks to an anonymous reviewer for this question.
10. The condition (c) can be understood as an idealization. In reality, one may only be able to establish that X_1 is *probably needed* for benefiting for Y_1. By replacing 'indispensable' with a weaker expression, such as 'probably needed', we get a slightly weaker version of complementarity and thus a slightly less ambitious, but more easily defendable argument for pluralism.
11. The addition 'at least' refers to the possibility that pluralism may be warranted by other reasons, which are not related to complementarity as understood here. In other words, strong complementarity relative to a valuable scientific goal, if it exists, is a sufficient and not a necessary justification for pluralism.
12. Although I focus on the complementarity-based argument for pluralism, there is another argument for pluralism that I should mention, because at the first glance it seems like the flipside of the complementarity-based argument. If there are disagreements about what the valuable goals are and this prohibits a consensus on what schools are complementary, perhaps this diversity of views justifies pluralism. Thus, the diversity of views about valuable scientific goals would always rescue the argument for pluralism when disagreement about the goals prevents formulating the complementarity-based argument in an appealing way. However, saying that the diversity of views about valuable scientific goals justifies pluralism presupposes that several of those diverse views are justified. And if they are, those valuable goals can be grouped together to constitute a broader, overarching goal G*, as I explained above. Even if G_1 and G_2 seem to be in conflict with each other, such as when X_1 and X_2 disagree on what a proper explanation amounts to, G* can be understood as the goal of developing both alternatives (perhaps with the intention to understand the conflict better and thereby help to resolve it). Thanks to an anonymous reviewer for advising me to clarify this.
13. Thanks to an anonymous reviewer for this question.

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